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## **RATCHET WRENCH HAVING EXACT LIMIT EFFECT**

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

4           The present invention relates to a ratchet wrench, and more  
5   particularly to a ratchet wrench having an exact limit effect.

#### **6 2. Description of the Related Art**

7           In general, a conventional ratchet wrench comprises a handle, a drive  
8   head mounted on a distal end of the handle and having a first end formed with  
9   a receiving hole, a mediate portion formed with a receiving recess  
10   communicating with the receiving hole, and a second end formed with a  
11   receiving chamber communicating with the receiving recess, a ratchet wheel  
12   mounted in the receiving hole of the drive head, a pawl member pivotally  
13   mounted in the receiving recess of the drive head and engaged with the ratchet  
14   wheel, and a control knob rotatably mounted in the receiving chamber of the  
15   drive head and rested on the pawl member to push the pawl member to press  
16   the ratchet wheel to control the drive direction of the ratchet wheel. Thus, by  
17   control of the control knob, the ratchet wheel is rotated in one direction only  
18   when the drive head is rotated.

19           However, the control knob is not easily positioned in the receiving  
20   chamber of the drive head rigidly and stably, thereby causing inconvenience to  
21   a user when operating the control knob. In addition, the conventional ratchet

1 wrench has a complicated construction, thereby greatly increasing the costs of  
2 fabrication.

## **SUMMARY OF THE INVENTION**

4 The present invention is to mitigate and/or obviate the disadvantage  
5 of the conventional ratchet wrench.

6 The primary objective of the present invention is to provide a ratchet  
7 wrench having an exact limit effect.

12 A further objective of the present invention is to provide a ratchet  
13 wrench, wherein the urging spring is supported and guided by the guide shaft  
14 of the positioning plate, so that the positioning plate is not easily deformed,  
15 thereby facilitating movement of the urging spring.

16 A further objective of the present invention is to provide a ratchet  
17 wrench, wherein the positioning plate is urged on the positioning edge of the  
18 pawl member rigidly and stably so as to position the pawl member exactly.

19 A further objective of the present invention is to provide a ratchet  
20 wrench, wherein the control knob is rigidly and stably positioned in the  
21 receiving chamber of the drive head by the limit spring, thereby facilitating a  
22 user operating the control knob.

1           In accordance with the present invention, there is provided a ratchet  
2   wrench, comprising:

3           a handle;

4           a drive head mounted on an end of the handle and having a first end  
5   formed with a receiving hole, a mediate portion formed with a receiving recess  
6   communicating with the receiving hole, and a second end formed with a  
7   receiving chamber communicating with the receiving recess;

8           a ratchet wheel mounted in the receiving hole of the drive head;

9           a pawl member pivotally mounted in the receiving recess of the drive  
10   head and engaged with the ratchet wheel;

11           a control knob rotatably mounted in the receiving chamber of the  
12   drive head and rested on the pawl member to push the pawl member to press  
13   the ratchet wheel, the control knob having an inside formed with a passage  
14   radially extended through the control knob; and

15           a substantially C-shaped limit spring mounted on the control knob to  
16   rotate with the control knob and having a mediate portion formed with a  
17   insertion portion inserted into the passage of the control knob and two distal  
18   ends each formed with an protruding locking portion that is movable to press  
19   the drive head to position the limit spring and the control knob on the drive  
20   head.

1           Further benefits and advantages of the present invention will become  
2           apparent after a careful reading of the detailed description with appropriate  
3           reference to the accompanying drawings.

4           **BRIEF DESCRIPTION OF THE DRAWINGS**

5           Fig. 1 is an exploded perspective view of a ratchet wrench in  
6           accordance with the preferred embodiment of the present invention;

7           Fig. 2 is a partially cut-away plan cross-sectional assembly view of  
8           the ratchet wrench as shown in Fig. 1;

9           Fig. 3 is a partially cut-away top plan cross-sectional assembly view  
10          of the ratchet wrench as shown in Fig. 1;

11          Fig. 4 is a partially cut-away top plan cross-sectional assembly view  
12          of a ratchet wrench in accordance with another embodiment of the present  
13          invention; and

14          Fig. 5 is a partially cut-away top plan cross-sectional assembly view  
15          of a ratchet wrench in accordance with another embodiment of the present  
16          invention.

17           **DETAILED DESCRIPTION OF THE INVENTION**

18          Referring to the drawings and initially to Figs. 1-3, a ratchet wrench  
19          in accordance with the preferred embodiment of the present invention  
20          comprises a handle 10, a drive head 11 mounted on an end of the handle 10 and  
21          having a first end formed with a receiving hole 12, a mediate portion formed  
22          with a receiving recess 13 communicating with the receiving hole 12, and a

1 second end formed with a receiving chamber 14 communicating with the  
2 receiving recess 13, a ratchet wheel 20 mounted in the receiving hole 12 of the  
3 drive head 11, a pawl member 25 pivotally mounted in the receiving recess 13  
4 of the drive head 11 and engaged with the ratchet wheel 20, and a control knob  
5 31 rotatably mounted in the receiving chamber 14 of the drive head 11 and  
6 rested on the pawl member 25 to push the pawl member 25 to press the ratchet  
7 wheel 20 to control the drive direction of the ratchet wheel 20. The  
8 above-mentioned structure and manner of operation are conventional and will  
9 not be further described in detail.

10 The ratchet wheel 20 is a substantially T-shaped socket. The ratchet  
11 wheel 20 has a periphery formed with a plurality of ratchet teeth 21 and has a  
12 bottom formed with an annular groove 22 for fixing a C-shaped snap ring 23  
13 which is rested on a bottom of the drive head 11 to secure the ratchet wheel 20  
14 on the drive head 11.

15 The pawl member 25 has a first side formed with a plurality of  
16 engaging teeth 26 engaged with the ratchet teeth 21 of the ratchet wheel 20 and  
17 a second side formed with an arcuate positioning edge 27.

18 The control knob 31 has an inside formed with a passage 32 radially  
19 extended through the control knob 31 and aligned with the positioning edge 27  
20 of the pawl member 25 and has a periphery formed with an annular snap  
21 groove 34. Preferably, the snap groove 34 of the control knob 31 is located  
22 under and communicated with the passage 32. The control knob 31 has a first

1 end formed with a drive handle 30 protruding outward from the drive head 11  
2 and a second end formed with an enlarged resting plate 33 located adjacent to  
3 the snap groove 34 and rested on the limit spring 35.

4 A substantially C-shaped limit spring 35 is mounted in the snap  
5 groove 34 of the control knob 31 to rotate with the control knob 31 and has a  
6 mediate portion formed with a substantially U-shaped insertion portion 36  
7 inserted into the passage 32 of the control knob 31 and two distal ends each  
8 formed with an arc-shaped protruding locking portion 37. The locking portion  
9 37 of the limit spring 35 is bent outward and is movable with the limit spring  
10 35 to abut a connection 18 of the receiving recess 13 and the receiving chamber  
11 14 of the drive head 11 as shown in Fig. 3 to enhance the positioning effect of  
12 the limit spring 35 on the control knob 31.

13 A substantially E-shaped positioning plate 40 is mounted in the  
14 passage 32 of the control knob 31 and has a first end rested on the positioning  
15 edge 27 of the pawl member 25, and an urging spring 45 is mounted in a  
16 second end of the positioning plate 40 and urged between the positioning plate  
17 40 and the drive head 11, so that the positioning plate 40 is urged on the  
18 positioning edge 27 of the pawl member 25 rigidly and stably as shown in Fig.  
19 2 so as to position the pawl member 25 exactly. The second end of the  
20 positioning plate 40 is formed with two slits 41 and a guide shaft 42 located  
21 between the two slits 41, and the urging spring 45 is mounted on the guide  
22 shaft 42 and located between the two slits 41. Thus, the urging spring 45 is

1 supported and guided by the guide shaft 42 of the positioning plate 40, so that  
2 the positioning plate 40 is not easily deformed, thereby facilitating movement  
3 of the urging spring 45. In addition, the positioning plate 40 has a bottom  
4 rested on the insertion portion 36 of the limit spring 35.

5 In operation, referring to Figs. 2 and 3 with reference to Fig. 1, the  
6 control knob 31 is rotated by the drive handle 30, so that the positioning plate  
7 40 mounted on the control knob 31 is moved by rotation of the control knob 31  
8 to push the pawl member 25 to move into an included angle defined by the  
9 ratchet wheel 20 and the inner edge of the drive head 11 to lock the ratchet  
10 wheel 20 on the drive head 11 so as to control the drive direction of the ratchet  
11 wheel 20. Thus, the ratchet wheel 20 is rotated in one direction only when the  
12 drive head 11 is rotated.

13 At the same time, when the control knob 31 is rotated, the limit  
14 spring 35 is also rotated. Thus, the locking portion 37 of one of the two distal  
15 ends of the limit spring 35 is moved to abut the connection 18 of the receiving  
16 recess 13 and the receiving chamber 14 of the drive head 11, and the locking  
17 portion 37 of the other one of the two distal ends of the limit spring 35 is  
18 moved to press an inner edge of the receiving chamber 14 of the drive head 11  
19 as shown in Fig. 3 to produce a locking effect on the control knob 31, so that  
20 the control knob 31 is rigidly and stably positioned in the receiving chamber 14  
21 of the drive head 11 by the limit spring 35, thereby facilitating a user operating  
22 the control knob 31.

1                   Accordingly, the ratchet wrench only needs to provide a limit spring  
2   35 to position the control knob 31 rigidly and stably, so that the ratchet wrench  
3   has a simplified construction, thereby decreasing costs of fabrication. In  
4   addition, the urging spring 45 is supported and guided by the guide shaft 42 of  
5   the positioning plate 40, so that the positioning plate 40 is not easily deformed,  
6   thereby facilitating movement of the urging spring 45. Further, the positioning  
7   plate 40 is urged on the positioning edge 27 of the pawl member 25 rigidly and  
8   stably so as to position the pawl member 25 exactly. Further, the control knob  
9   31 is rigidly and stably positioned in the receiving chamber 14 of the drive  
10   head 11 by the limit spring 35, thereby facilitating a user operating the control  
11   knob 31.

12                  Referring to Fig. 4, in accordance with another embodiment of the  
13   present invention, the receiving chamber 14 of the drive head 11 has a wall  
14   formed with two spaced arch-shaped locking recesses 15 located adjacent to  
15   the handle 10. The control knob 31 has an inner side facing the pawl member  
16   25, and the limit spring 35 is mounted on the inner side of the control knob 31,  
17   wherein the locking portion 37 of one of the two distal ends of the limit spring  
18   35 is inserted into and locked in a respective one of the two locking recesses 15  
19   of the drive head 11, so that the control knob 31 is rigidly and stably positioned  
20   in the receiving chamber 14 of the drive head 11 by the limit spring 35, thereby  
21   facilitating a user operating the control knob 31.

1 Referring to Fig. 5, in accordance with another embodiment of the  
2 present invention, the receiving chamber 14 of the drive head 11 has a wall  
3 formed with an arch-shaped locking recess 16 located adjacent to the handle 10.  
4 The control knob 31 has an inner side facing the pawl member 25, and the limit  
5 spring 35 is mounted on the inner side of the control knob 31, wherein the  
6 locking portion 37 of either one of the two distal ends of the limit spring 35 is  
7 inserted into and locked in the locking recess 15 of the drive head 11, so that  
8 the control knob 31 is rigidly and stably positioned in the receiving chamber 14  
9 of the drive head 11 by the limit spring 35, thereby facilitating a user operating  
10 the control knob 31.

11 Although the invention has been explained in relation to its preferred  
12 embodiment(s) as mentioned above, it is to be understood that many other  
13 possible modifications and variations can be made without departing from the  
14 scope of the present invention. It is, therefore, contemplated that the appended  
15 claim or claims will cover such modifications and variations that fall within the  
16 true scope of the invention.